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EFFECT OF ETHREL, 2,4-D AND MH ON GROWTH, RHIZOME YIELD AND DIOSGENIN CONTENT IN *COSTUS SPECIOSUS* (KOENING) SMITH

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Abstract: An experiment to study the effect of ethrel, 2,4-D and MH on the growth, rhizome yield and diosgenin content in *Costus speciosus* was conducted at the College of Horticulture, Vellanikkara. Plant height was significantly reduced by ethrel and MM at the levels tried. Ethrel 100 and 200 ppm significantly increased the number of tillers per plant. The length, width and leaf area and internodal length of shoot was significantly reduced by ethrel treatments while total leaf area was higher in plants treated with 2,4-D (10 and 20 ppm). Ethrel 200 ppm recorded maximum yield of green and dry rhizomes. Diosgenin content of the rhizome was found to be the highest in the plants treated with 2,4-D 10 ppm. Shoot/rhizome ratio was significantly reduced by Ml I treatments.

Key words: Ethrel, 2,4-D, MH, *Costus speciosus*, growth regulators

INTRODUCTION

Costus speciosus (Koening) Smith is a perennial herb with tuberous rhizomes, belonging to family Zingiberaceae. The crop acquired commercial significance with the isolation by Dasgupta and Pandey (1970) of diosgenin, an important steroid drug precursor. A series of trials had been conducted by the Kerala Agricultural University for evolving the package of practices for this crop and to raise its status as a commercial crop. The present study analyses the influence of growth substances on the growth, yield and quality of *Costus speciosns.*

MATERIALS AND METHODS

Investigations on the effect of ethrel, 2,4-D and maleic hydrazide on the growth, rhizome yield and diosgenin content in *Costus speciosns* were carried out in randomised block design with three replications. The treatments were ethrel 100 ppm, 200 ppm, 300 ppm, 2,4-D 10 ppm, 20 ppm, 30 ppm, MH 50 ppm, 100 ppm, 150 ppm, water spray and absolute control. Spraying of growth regulators was done three times at monthly intervals, starting from two months after planting. Rhizome pieces weighing approximately 75 g each with a minimum of two buds were planted at a depth of 10 cm on raised beds with a spacing of 60 cm x 60 cm giving a total population of 25 plants per plot. Soil surface was mulched with green leaves and NPK at the rate of 45:30:30 kg ha^{-1} applied in two split doses. Observations on growth characters were taken four times at monthly intervals from 10 days prior to first spraying and those on yield and quality were recorded after harvesting the crop at nine month.

RESULTS AND DISCUSSION

The growth parameters studied, namely, the height of plant, the internodal length, the number of tillers, the number of leaves and leaf area were found to be significantly influenced by the application of the growth substances. The internodal length and girth of the main rhizomes, the number and length of primary fingers and the number of secondary fingers were also significantly influenced by ethrel, 2,4-D and MH treatments.

At the levels tried, ethrel showed an inhibitory effect on plant height and produced plants shorter than the other treatments. Internodal length of shoot was significantly reduced by the three levels of ethrel (Table 1). Plant height was also reduced by the levels of MH while no such inhibitory effect was observed in 2,4- D treated plants. The inhibitory effect of

Table 1. Shoot characters under different levels of ethrel, 2,4-D and MH

Treatments		Plant height (cm)				Tiller production (nos.)				Internodal length of shoot (cm)
		50th day	80th day	110th day	140th day	50th day	80th day	110th day	140th day	
Ethrel	100 ppm	32.10	39.36	48.46	50.31	3.17	5.16	7.16	7.75	2.53
"	200 ppm	30.99	38.12	47.60	47.50	4.08	6.08	8.08	8.08	2.09
"	300 ppm	32.18	39.49	46.64	47.85	3.41	4.50	5.42	5.58	1.41
2,4-D	10 ppm	37.37	52.91	66.04	66.04	2.83	4.00	5.08	5.58	2.78
"	20 ppm	40.50	53.72	72.84	71.40	3.41	4.17	4.75	4.75	3.20
"	30 ppm	35.74	52.02	69.67	67.38	3.25	4.25	4.67	4.75	2.87
MH	50 ppm	36.37	46.70	57.73	57.67	3.50	5.41	6.50	6.42	3.06
"	100 ppm	39.05	46.86	54.21	57.93	3.33	4.60	5.50	5.67	2.96
"	150 ppm	34.83	44.09	52.20	55.20	3.25	5.00	5.50	5.50	2.83
Water spray		39.14	53.73	67.75	66.56	3.17	3.91	4.42	4.42	3.00
Absol. control		35.25	52.51	69.90	70.18	3.08	4.59	5.17	5.25	3.18
CD(0.05)		7.74	8.08	10.20	9.49	1.04	0.84	0.99	1.00	0.57

ethrel on the height of plants and internodal length as observed in the present study is in conformity with the report of Jayachandran (1978) in ginger and Vahab (1980) in sweet potato. Inhibitory effect of MH on plant height can be attributed to the inhibition of meristematic activities in the shoot tip by MH and consequent reduction in height (Krishnamoorthy, 1981).

Tiller production was significantly higher in plants treated with ethrel at 100 and 200 ppm and MH 50 ppm. Enhancement of tiller production as a result of application of ethrel and MH has been reported by Vahab (1980) in sweet potato and George (1981) in turmeric, respectively.

The leaf area in general was reduced in plants treated with ethrel. Individual leaf area was significantly higher in plants treated with 2,4-D 10 and 20 ppm on the 110th and 140th days (Table 2). The reduction in leaf area observed in ethrel treated plants may be attributed to the reduction in the leaf size and severe defoliation observed at the later stages of growth. Vahab (1980) in sweet potato and Rajmohan (1978) in *Coleus parviflorus* reported similar inhibitory effects of ethrel on leaf area. The increase in leaf area by the application of 2,4-D at the lower levels, observed in the present studies, is supported by the findings of Kabdal and Joshi (1978) in *Crocus sativus*.

The internodal length of main rhizome was increased by 2,4-D 10 ppm. The length of primary and secondary fingers was significantly increased by the ethrel 100 and 200 ppm. The length of

primary fingers was also significantly increased by 2,4-D at 10 and 20 ppm (Table 3). Increase in length and number of tubers due to ethrel application has been reported by Vahab (1980) in sweet potato. The increase in the girth of main rhizome brought about by ethrel may be due to the ethylene induced lateral swelling of cells and the isodiametrical expansion of tubers, as reported by Krishnamoorthy (1981). Enhancement of multiplication of corms by application of 2,4-D has been reported by Kabdal and Joshi (1978) in *Crocus sativus*.

Among the treatments, ethrel 200 ppm recorded the highest yield of green rhizome followed by ethrel 100 ppm and 2,4-D 10 and 20 ppm. The dry matter percentage of the rhizome was increased significantly by ethrel 200 ppm and by ethrel treatments in general (Table 4). Significant increase in yield and dry matter content due to ethrel application has been reported by Rajmohan (1978) in *Coleus parviflorus* and Vahab (1980) in sweet potato.

Table 2. Leaf production and leaf area (cm^2) as influenced by the different levels of ethrel, 2,4-D and MH

Treatments		50th day		80th day		110th day		140th day	
		Leaves per plant	Leaf area per plant (cm^2)	Leaves per plant	Leaf area per plant (cm^2)	Leaves per plant	Leaf area per plant (cm^2)	Leaves per plant	Leaf area per plant (cm^2)
Ethrel	100 ppm	39.16	1013	63.58	2168	76.75	2313	37.83	1774
Ethrel	200 ppm	38.60	970	62.92	2066	73.41	2103	47.83	2075
Ethrel	300 ppm	35.58	1001	54.58	2000	67.33	2015	42.00	1994
2,4-D	10 ppm	32.08	1028	61.25	3902	73.08	8463	65.58	8371
"	20 ppm	34.08	1039	55.67	3760	65.00	6092	52.58	5243
"	30 ppm	24.81	915	40.66	2124	44.58	3289	37.05	2170
MH	50 ppm	37,50	1233	59.17	3604	72.75	5300	57.05	3794
"	100 ppm	29.91	871	45.00	2557	54.00	4190	43.83	2950
"	150 ppm	30.91	867	44.58	2267	53.83	3483	37.05	2188
Water spray		37.58	1176	53.66	3188	62.75	4903	52.25	3982
Absol. control		34.92	1088	52.91	2997	60.83	4800	51.83	3723
CD(0.05)			424		1126		1479		1347

Diosgenin content of the rhizome was also found to be influenced significantly by the application of growth substances. Maximum content of diosgenin in the rhizome was found in plants treated with 2,4-D 10 ppm, ethrel 200 ppm and MH 100 ppm as the treatments were statistically on par. However, significant increase in diosgenin yield per hectare was recorded only by ethrel 200 ppm, 2,4-D 10 ppm and MH 50 ppm. Among these, ethrel 200 ppm produced the maximum diosgenin yield per hectare, significantly higher than the others (Table 4). Ethrel has

Table 3. Rhizome characters in plants under different levels of ethrel, 2,4-D and MH

Treatments	Main rhizome				Primary rhizomes				Secondary rhizomes			
	No.	Length (cm)	IL	Girth (cm)	No.	Length (cm)	IL	Girth (cm)	No.	Length (cm)	IL	Girth (cm)
Ethrel 100 ppm	1.67	31.75	2.27	9.62	7.66	11.85	1.54	7.92	4.18	3.07	1.07	5.37
" 200 ppm	1.90	32.50	2.07	10.29	8.00	15.07	1.65	8.05	3.42	3.19	1.06	4.89
" 300 ppm	1.67	25.38	1.93	8.02	5.25	10.90	1.53	6.50	2.08	2.62	0.90	4.56
2,4-D 10 ppm	1.67	40.09	3.08	8.63	6.25	14.37	1.77	6.89	1.92	2.35	1.11	3.87
" 20 ppm	1.75	29.97	2.51	7.96	5.58	13.67	1.71	6.97	2.33	3.05	0.99	5.01
" 30 ppm	1.67	27.75	2.42	7.88	4.83	11.59	1.60	7.07	1.92	3.68	1.14	4.48
MH 50 ppm	2.33	27.64	2.26	8.24	5.18	10.56	1.75	6.76	1.17	3.67	1.16	4.67
" 100 ppm	2.00	43.37	2.47	8.38	4.83	13.31	1.68	6.95	1.83	2.39	1.07	4.88
" 150 ppm	1.99	27.03	2.26	8.35	5.08	14.03	1.62	7.26	2.67	2.45	0.98	5.08
Water spray	1.67	5.21	2.86	8.44	4.83	12.30	1.72	6.25	1.91	2.47	0.10	4.75
Absol. control	1.58	30.16	2.34	8.08	4.03	12.22	1.71	6.12	1.33	3.30	1.26	4.78
CD(0.05)	0.70	12.89	0.52	1.17	1.43	2.45	0.21	1.41	1.28	1.72	0.40	0.98

* IL = Internodal length, cm

been reported to enhance the volatile oil content in ginger (Jayachandran, 1978). Improvement in the content and yield of diosgenin and related compounds as a result of application of 2,4-D has been observed by Vasanthakumar *et al.* (1980) in *Dioscorea floribunda.* George (1980) reported significant increase in the curcumin percentage in turmeric with 50 ppm MH.

The shoot/rhizome ratio was found to be significantly reduced by ethrel followed by MH treatments (Table 4). Vahab (1980) in sweet potato and Rajmohan (1975) in *Coleus parviflorus* also observed reduced shoot/tuber ratio with ethrel application. The reduced shoot growth as well as the increased rhizome yield observed in plants treated with ethrel, may have contributed towards the reduced shoot/rhizome ratio.

Table 4. Green and dry rhizome yields, dry matter and diosgenin content, yield of diosgenin and rhizome ratio under different levels of ethrel, 2,4-D and MH

Treatments	Yield of green rhizomes t ha^{-1}	Dry matter content (%)	Yield of dry rhizomes t ha^{-1}	Diosgenin content (%)	Yield of diosgenin t ha^{-1}	Shoot/ rhizome ratio
Ethrel 100 ppm	34.76	26.20	9.06	1.52	138.50	0.21
" 200 ppm	42.28	28.30	12.15	1.64	197.43	0.23
" 300 ppm	23.54	25.33	5.79	1.17	68.85	0.19
2,4-D 10 ppm	35.50	19.23	6.89	1.83	126.30	0.36
" 20 ppm	34.44	18.13	6.24	1.57	99.01	0.32
" 30 ppm	23.81	19.00	4.53	1.14	51.30	0.42
MH 50 ppm	29.74	25.00	7.32	1.59	116.28	0.26
" 100 ppm	32.01	21.16	6.79	1.64	112.48	0.25
" 150 ppm	23.91	18.60	4.48	1.26	55.62	0.24
Water spray	25.23	18.03	4.57	1.14	51.74	0.41
Absol. control	26.34	20.93	6.05	1.16	70.56	0.40
CD(0.05)	6.35	5.91	2.67	0.21	44.04	0.12

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